Ref. No.: Ex/Arch/CE/T/323/2025

Bachelor of Architecture, Third Year Second Semester Examination, 2025

DESIGN OF STRUCTURES – II

Full Marks – 100 **Time: 3 Hrs.**

- **Answer Any FIVE Questions.**
- **The use of the following IS Codes is allowed in the examination hall:**
  IS-456:2000, SP-16, IS:800:2007, IS:808-1989, IS:4923-2017, IS:1161-2014, SP-6-Part-1

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1. Design a two-way RC Slab for a rectangular panel of 4.8 m. X 3 m. with all the edges simply supported (and the corners are prevented from lifting) to support a Live Load of 3 kN/m^2, apart from the self-weight of the slab. Use M-20 grade concrete and Fe-500 grade reinforcement steel. Draw the plan and cross-section of the slab showing the reinforcement details. Assume any other data as required and mention them specifically.

2. Determine the Ultimate Moment of Resistance of a Doubly Reinforced Beam Section of 300 mm wide X 500 mm depth, reinforced with Tension Steel – 8 numbers 20 mm diameter bars, and Compression Steel – 3 numbers 20 mm diameter bars. The Grade of Concrete is M20 and the Grade of Reinforcement Steel is Fe500. Assume the clear cover is 30 mm at the top and bottom faces.

3. Determine the reinforcements to be provided in a short column subjected to an axial load and biaxial moments. The Column cross-section is 300 mm X 450 mm., subject to the following external forces – (a) a factored axial load of 800 kN; (b) a factored moment acting parallel to the larger dimension of the column of 120 kN.m. and (c) a factored moment acting parallel to the shorter dimension of the column of 80 kN.m. Use M-20 grade of concrete and Fe-500 grade of reinforcement steel. The moments due to minimum eccentricities as per code are less than the applied moments. The reinforcements are distributed equally on the four sides of the column. Draw the column cross-section at the base of the column showing the reinforcement details. Assume any other data as required and mention them specifically.

4. An RCC Column, having a rectangular cross-section of dimension 300 mm X 500 mm, is subjected to an Axial Compressive Load of 180 kN, with Bi-Axial Moments of 90 kN.m. about the major axis and 50 kN.m. about the minor axis of the column, orthogonal to each other. Provide an RCC rectangular footing of dimension 1.20 m x 2.00 m for that column.
   (a) Calculate the Bearing Pressure developed at the four corners of the footing.
   (b) Please check whether any tension zone has developed under the footing. (Loses contact with the soil)
   (c) Considering the Allowable Bearing Capacity of the underneath soil as 120 kN/m^2, comment on the factor of safety of the footing from the bearing capacity point of view.

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5. Write down the step-by-step procedure for finding the Major Axis Bending Moment Capacity of a doubly-symmetric Steel I-section Laterally Unrestrained Beam using the clauses of the IS:800-2007 Code. Please mention all the relevant clauses of the code at each step.

6. Determine the Section Class of the following sections:
   (A) A Built-up Channel Section (using steel plates) having an Overall Depth of 300 mm, Flange Width = 100 mm, Flange Thickness = 8 mm, Web Thickness = 6 mm and FYLD = 250 MPa.
   (B) Hot Rolled Equal Angle Section: ISA 150 x 150 x 12, having FYLD = 250 MPa.
   (C) A Rectangular Hollow Tube Section, External Dimensions – 300 mm X 150 mm x Wall Thk. 6 mm. Yield Strength = 310 MPa.

7. A Steel Plate Girder having a span of 10 meters, is subjected to an imposed load of 15 kN/m, apart from its self-weight. The Girder is simply supported at both ends. The compression flange of the girder is laterally restrained throughout the span.
   The Plate Girder is fabricated with the following dimensions:
   Total Depth of the Girder = 750 mm
   Top and Bottom Flange Dimension = 400 mm x 25 mm
   The thickness of the Web = 10 mm
   Yield Strength of Steel is 250 MPa.
   Calculate -
   (a) Major Axis Bending moment capacity of the Girder and
   (b) Check whether the provided section can carry the applied loading.
